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Nakano et al.

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(54) **CONNECTOR HOLDER UNIT, CARRIAGE, RECORDING APPARATUS, AND LIQUID EJECTING APPARATUS**

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(73) Assignee: **Seiko Epson Corporation**, Tokyo (JP)

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Jun. 22, 2006 (JP) 2006-173003

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B41J 2/14 (2006.01)
B41J 2/175 (2006.01)

(52) **U.S. Cl.** **347/50**; 347/86

(58) **Field of Classification Search** 347/50, 347/86

See application file for complete search history.

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(57) **ABSTRACT**

A connector holder unit that is formed separately from a carriage capable of housing an ink cartridge and can be attached to the inside of the carriage includes a connector holder, a connector having a plurality of contact arms that is installed to the connector holder, and a circuit substrate having a plurality of conductive connection portions that is installed to the connector holder, wherein contact terminals of the plurality of contact arms of the connector are configured to elastically contact the conductive connection portions of the circuit substrate and conductive connection portions of the ink cartridge so as to electrically conduct between the circuit substrate and the ink cartridge when the connector holder unit is attached to the carriage.

6 Claims, 11 Drawing Sheets

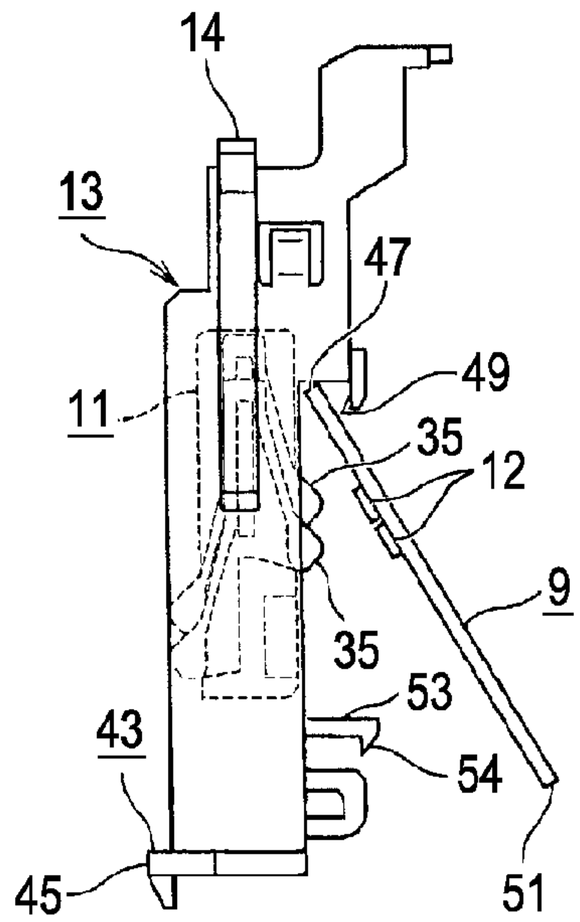


FIG. 1

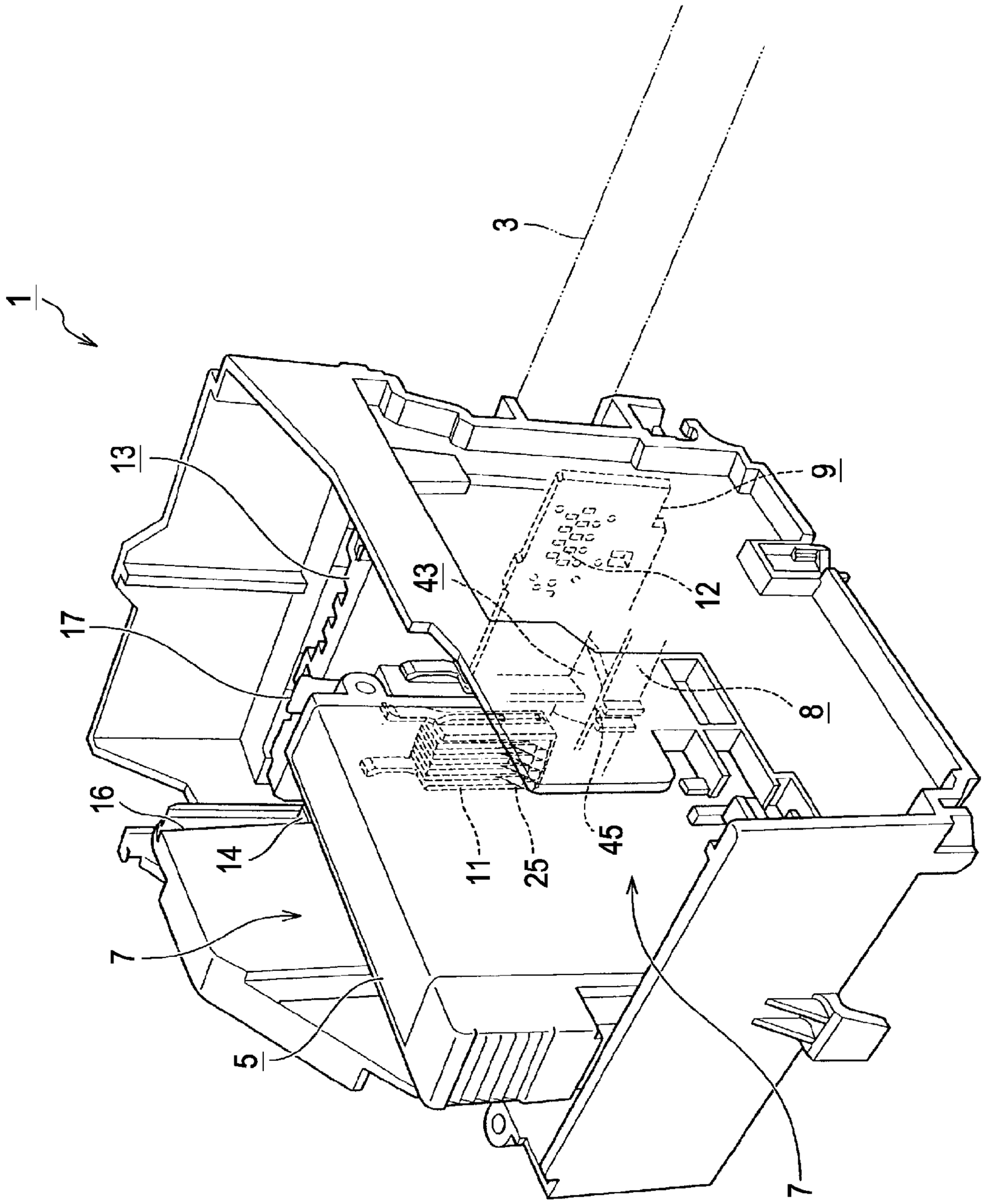
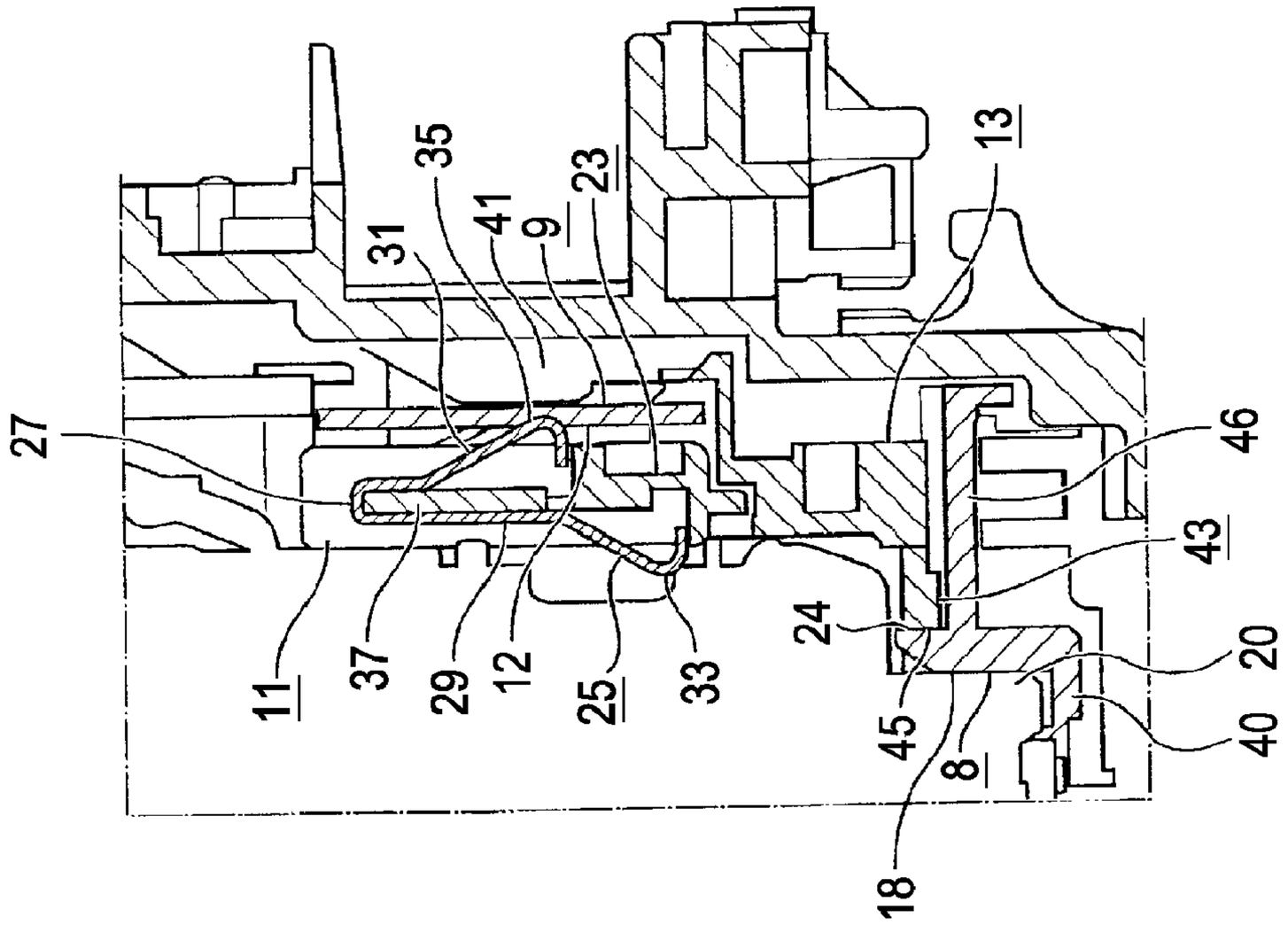


FIG. 2B


27
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35
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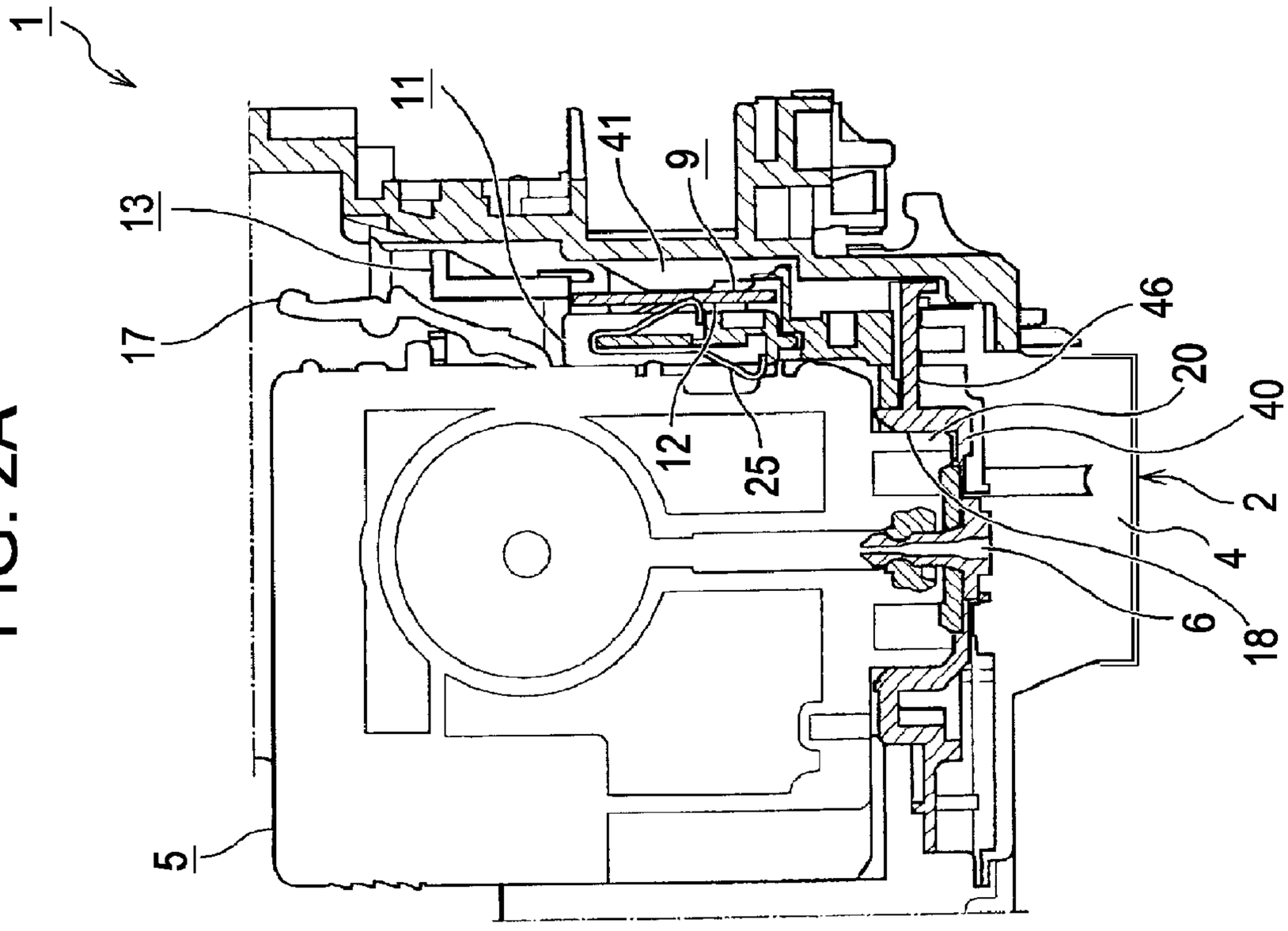
FIG. 2A


1
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18
5

FIG. 3

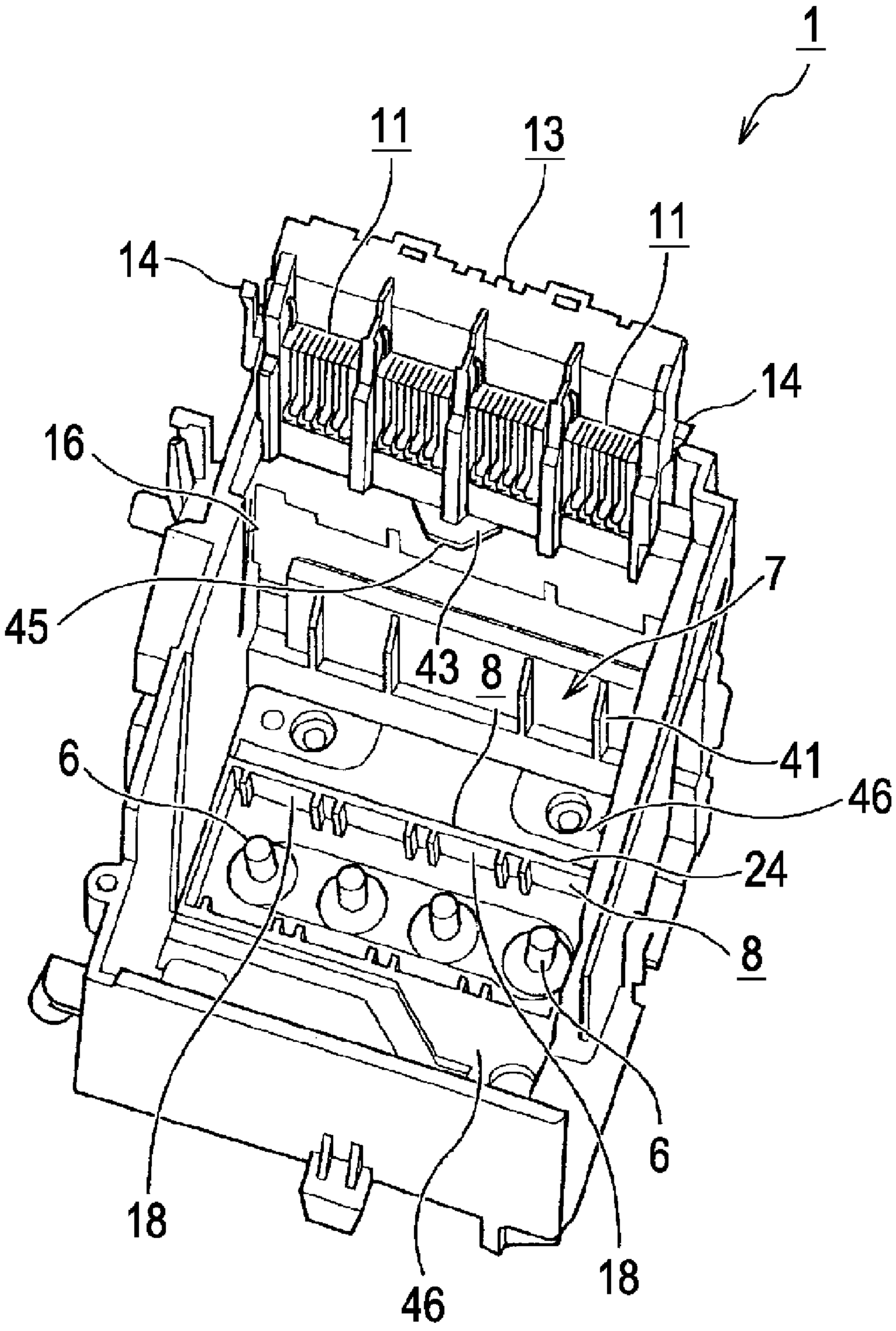
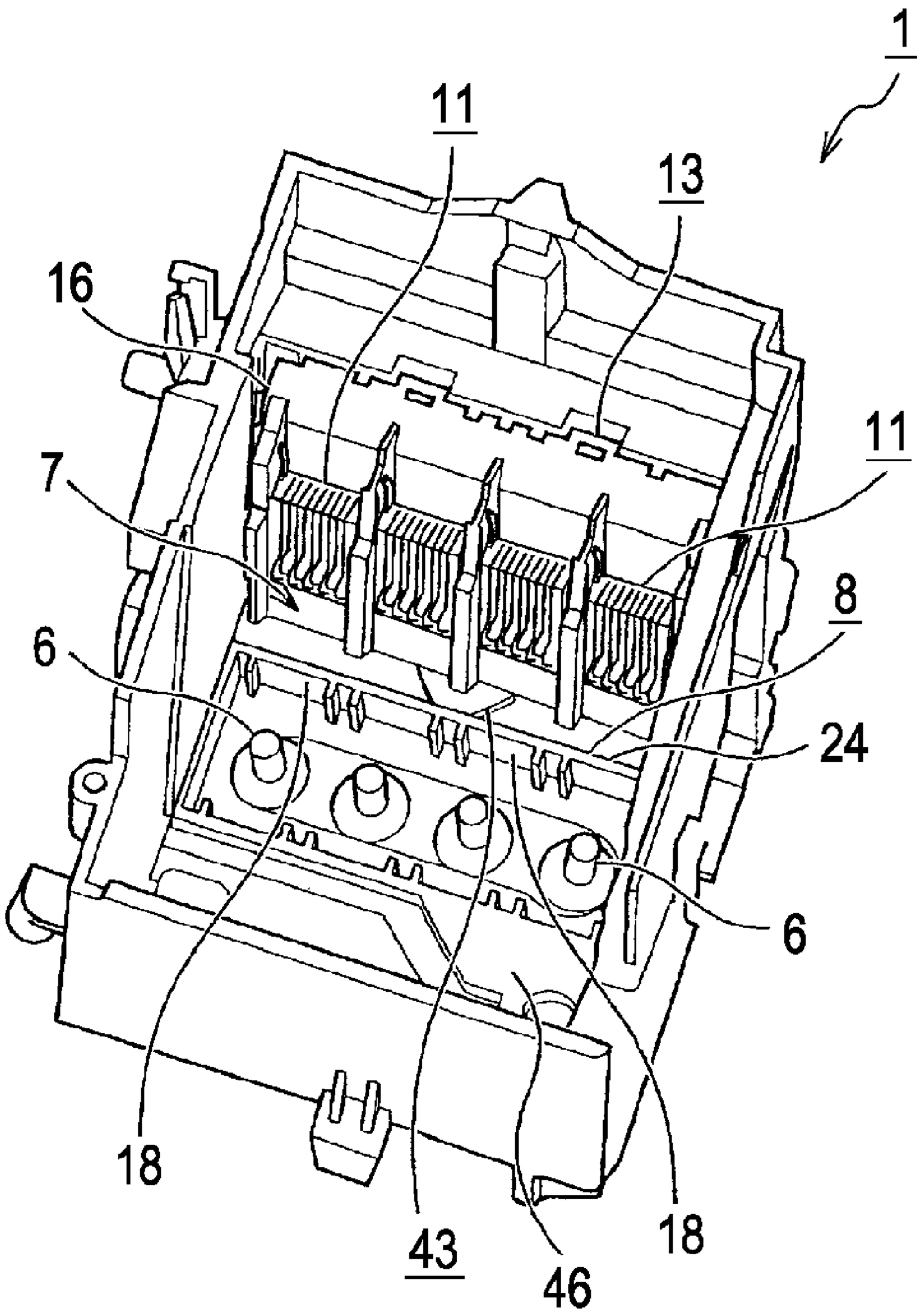


FIG. 4



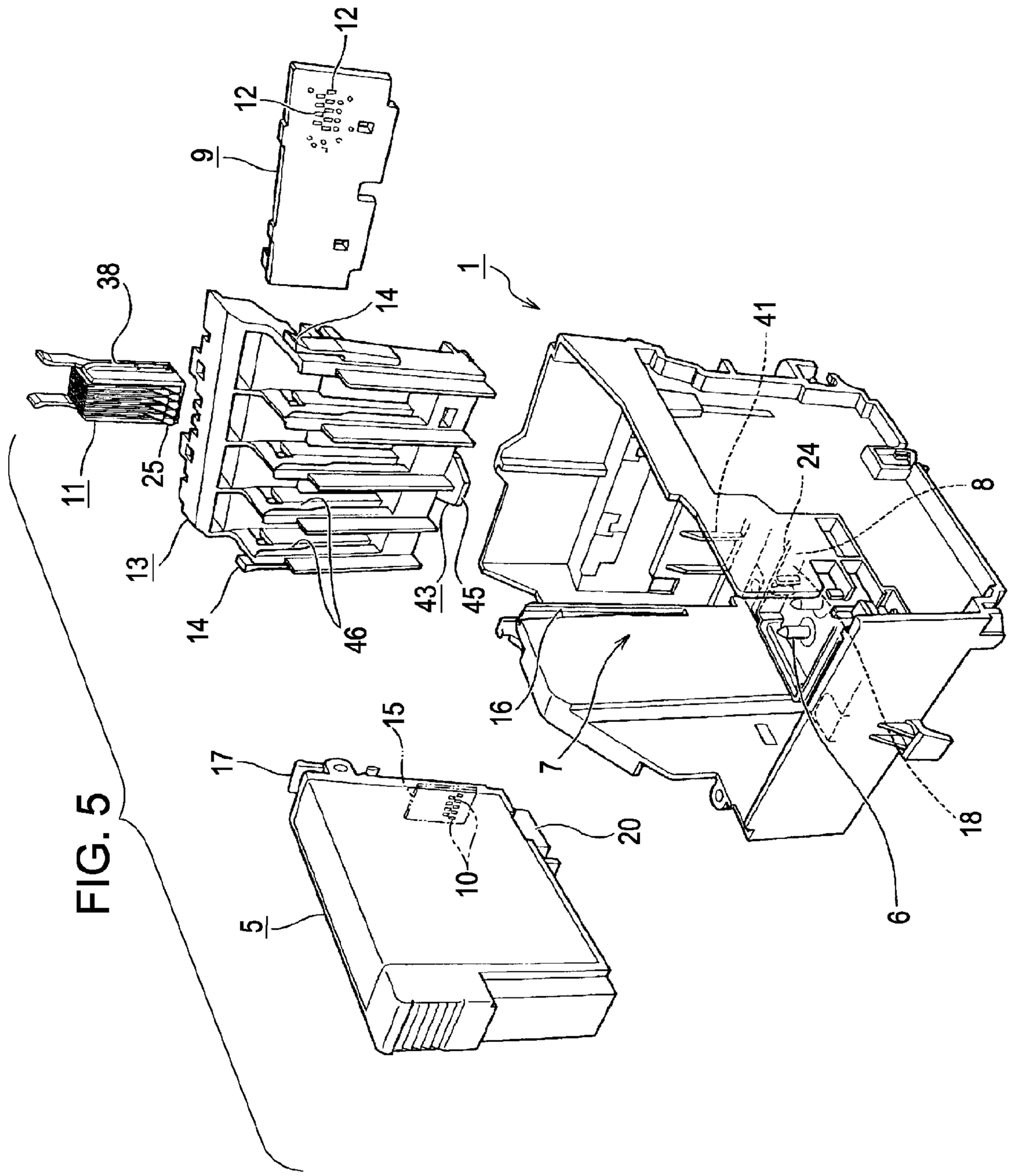


FIG. 5

FIG. 6

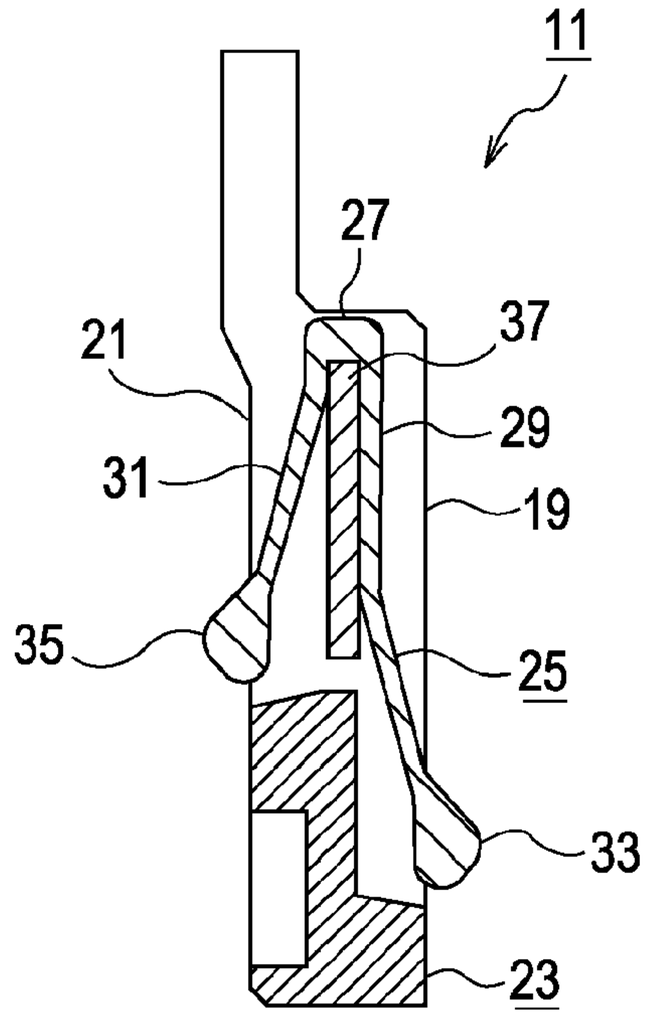


FIG. 7

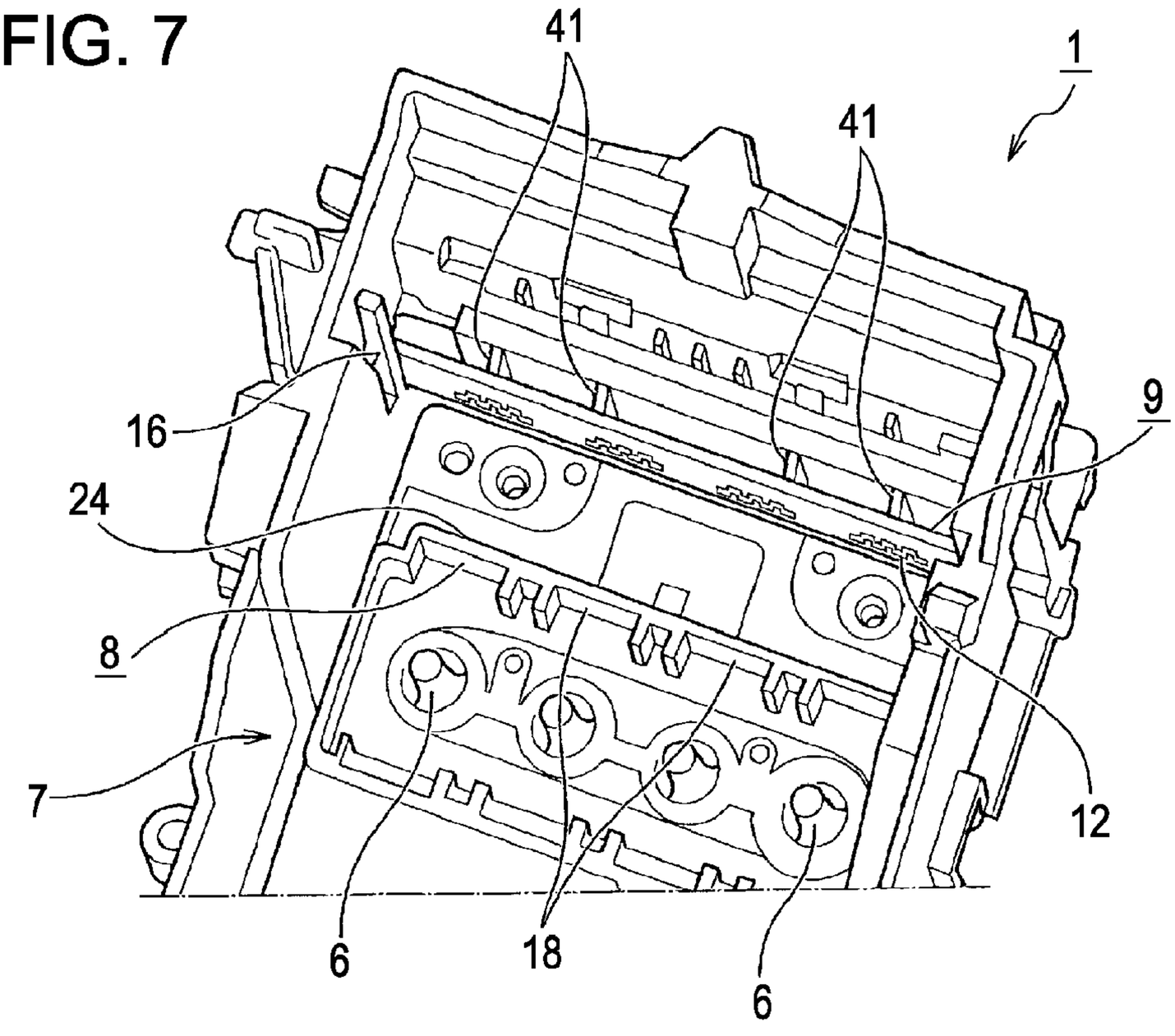


FIG. 8

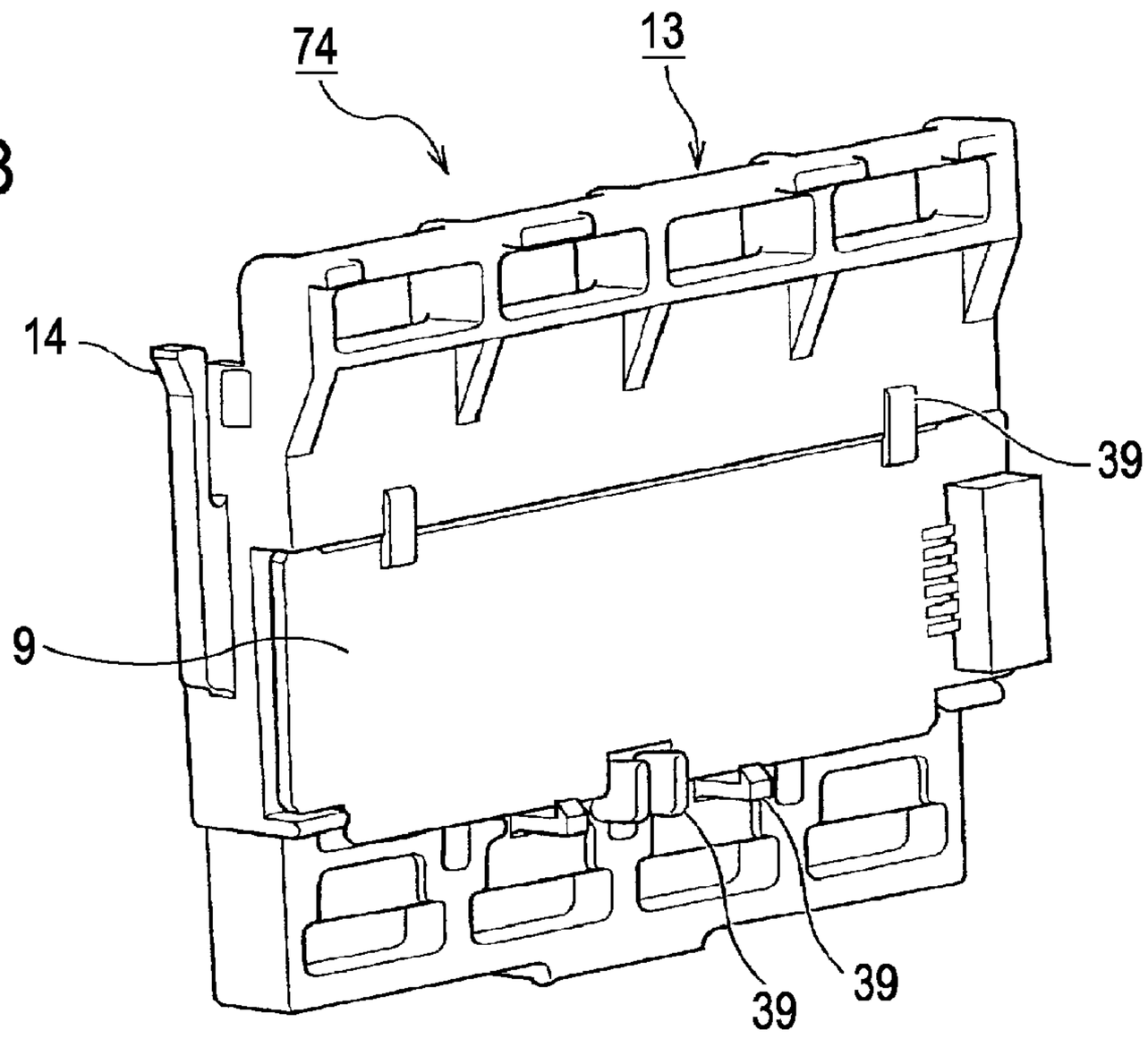
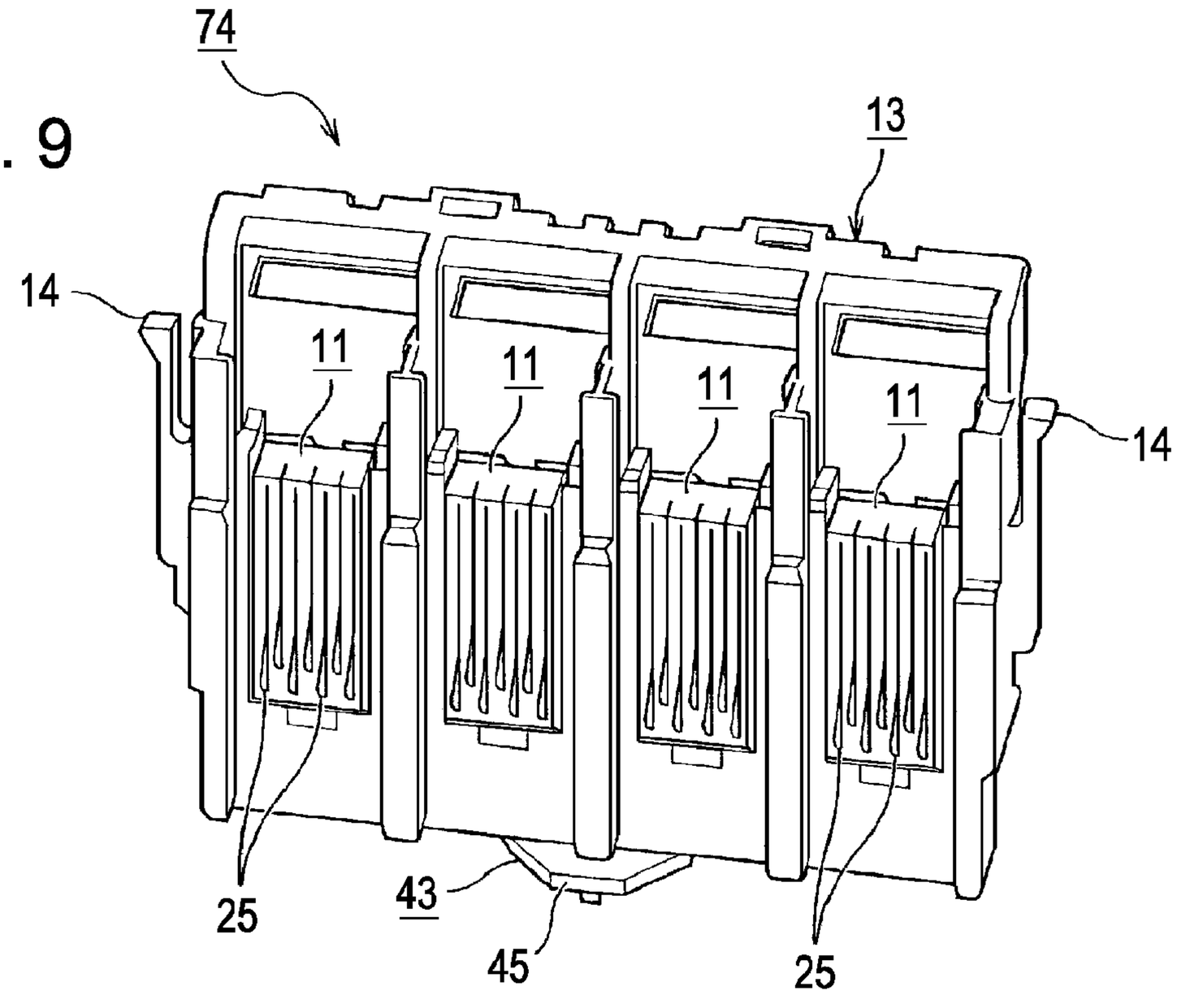


FIG. 9



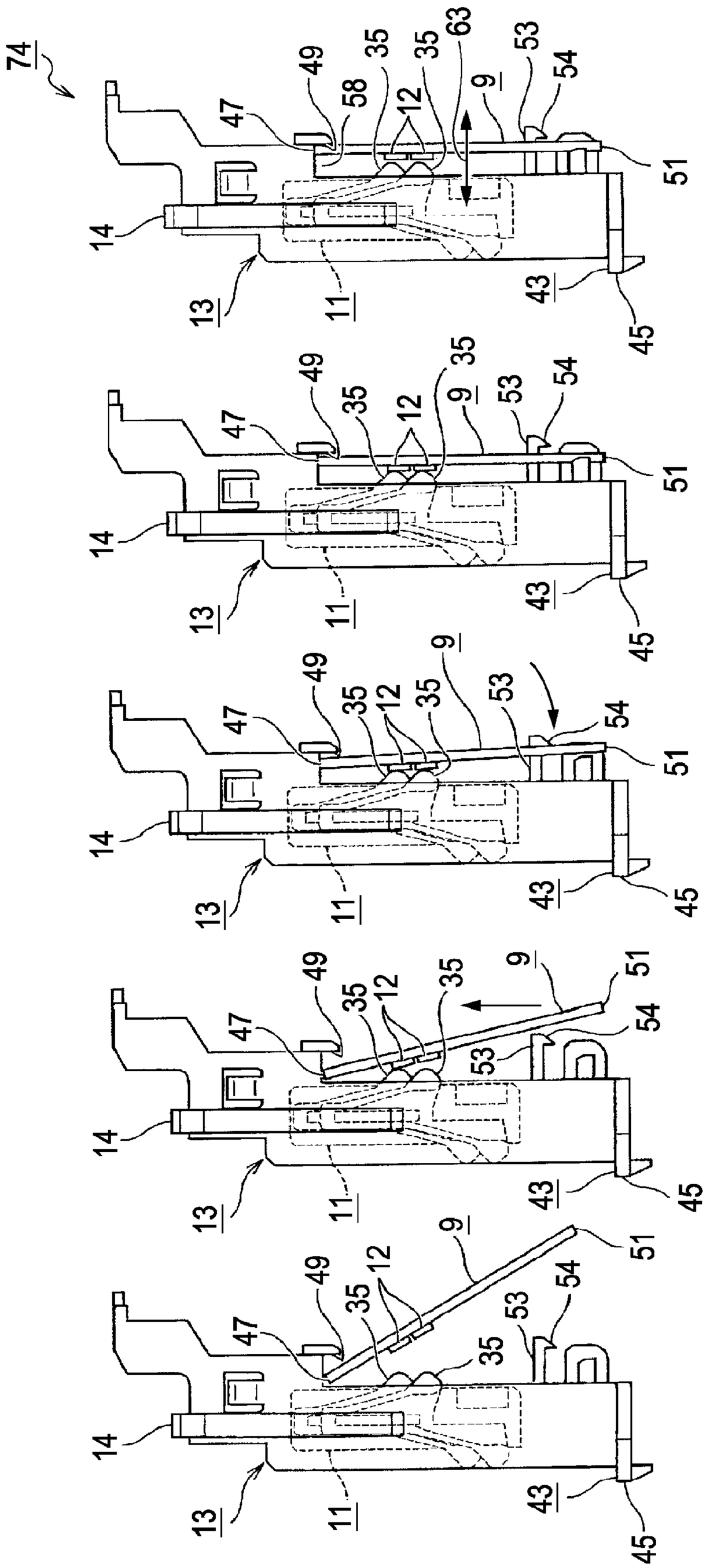


FIG. 10E

FIG. 10D

FIG. 10C

FIG. 10B

FIG. 10A

FIG. 11D

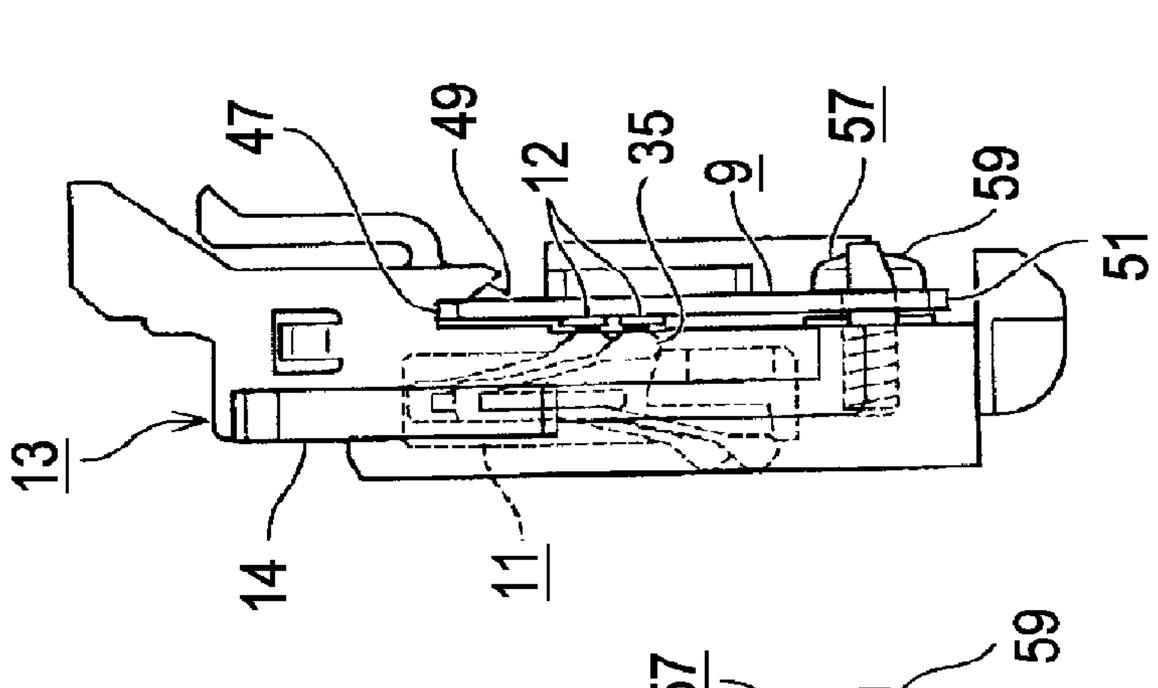


FIG. 11C

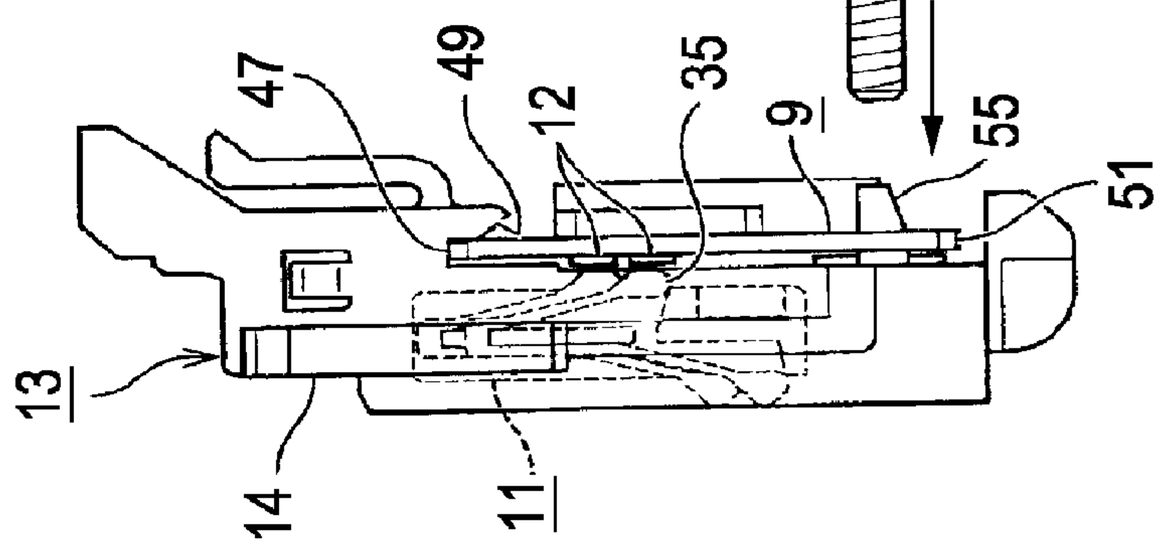


FIG. 11B

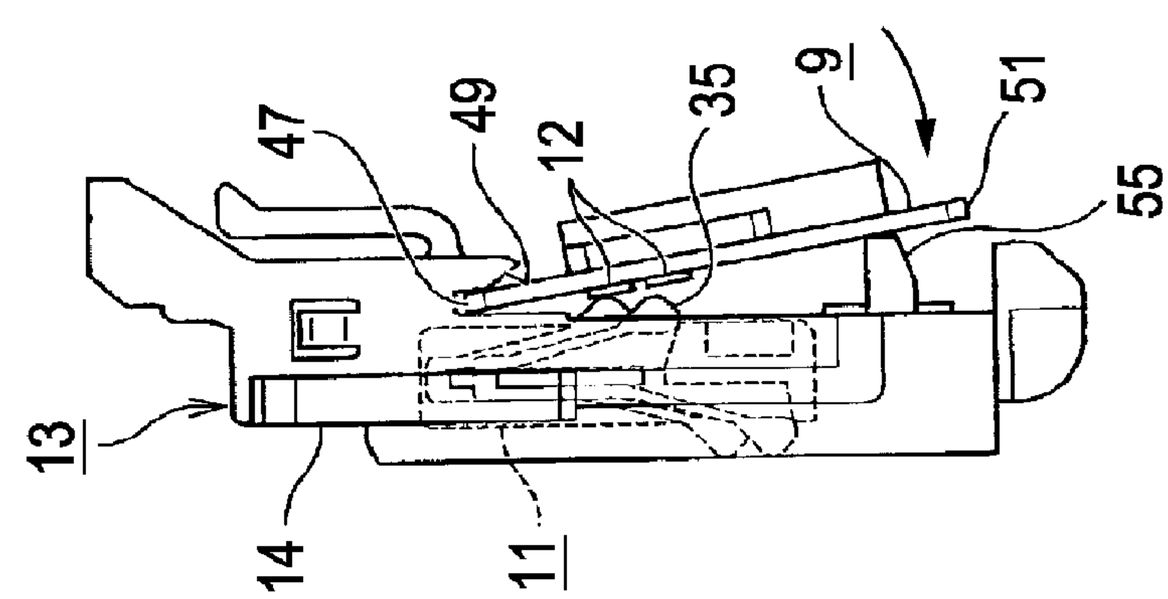


FIG. 11A

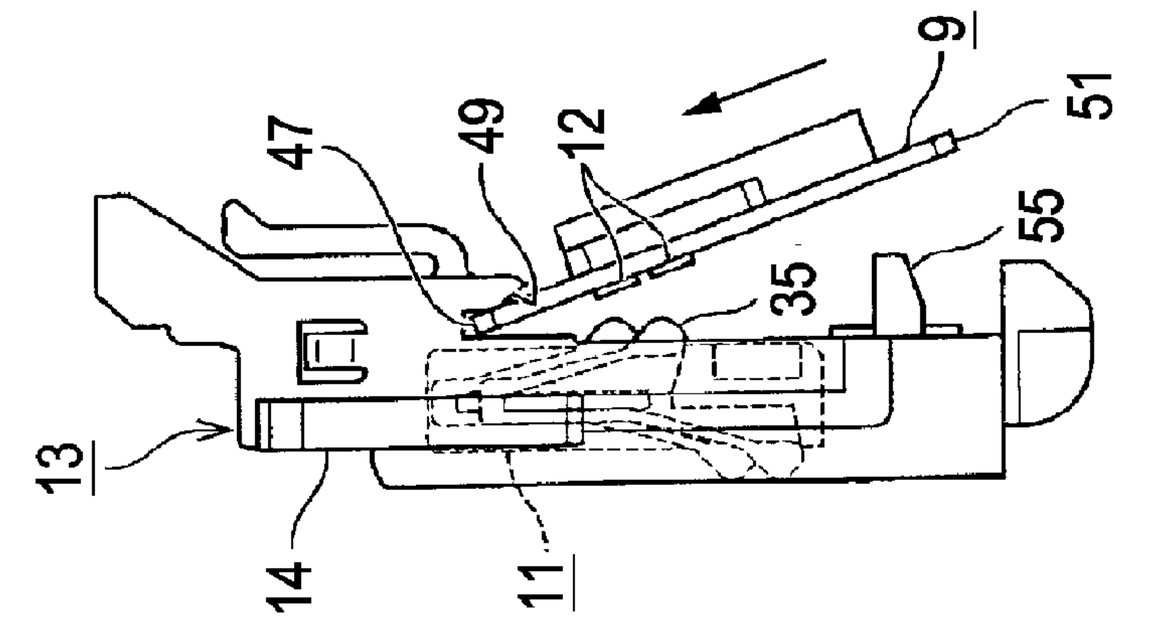


FIG. 12

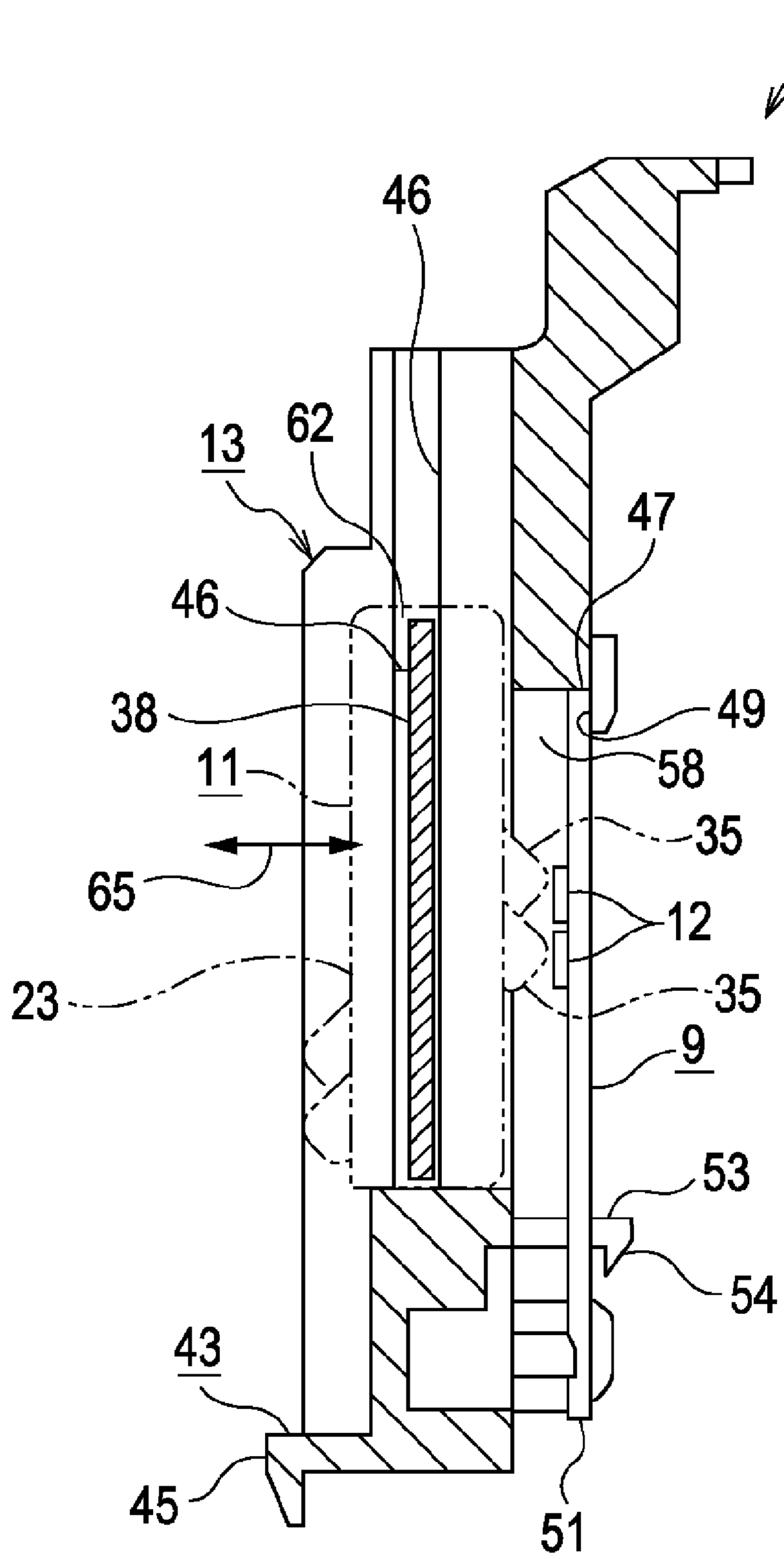
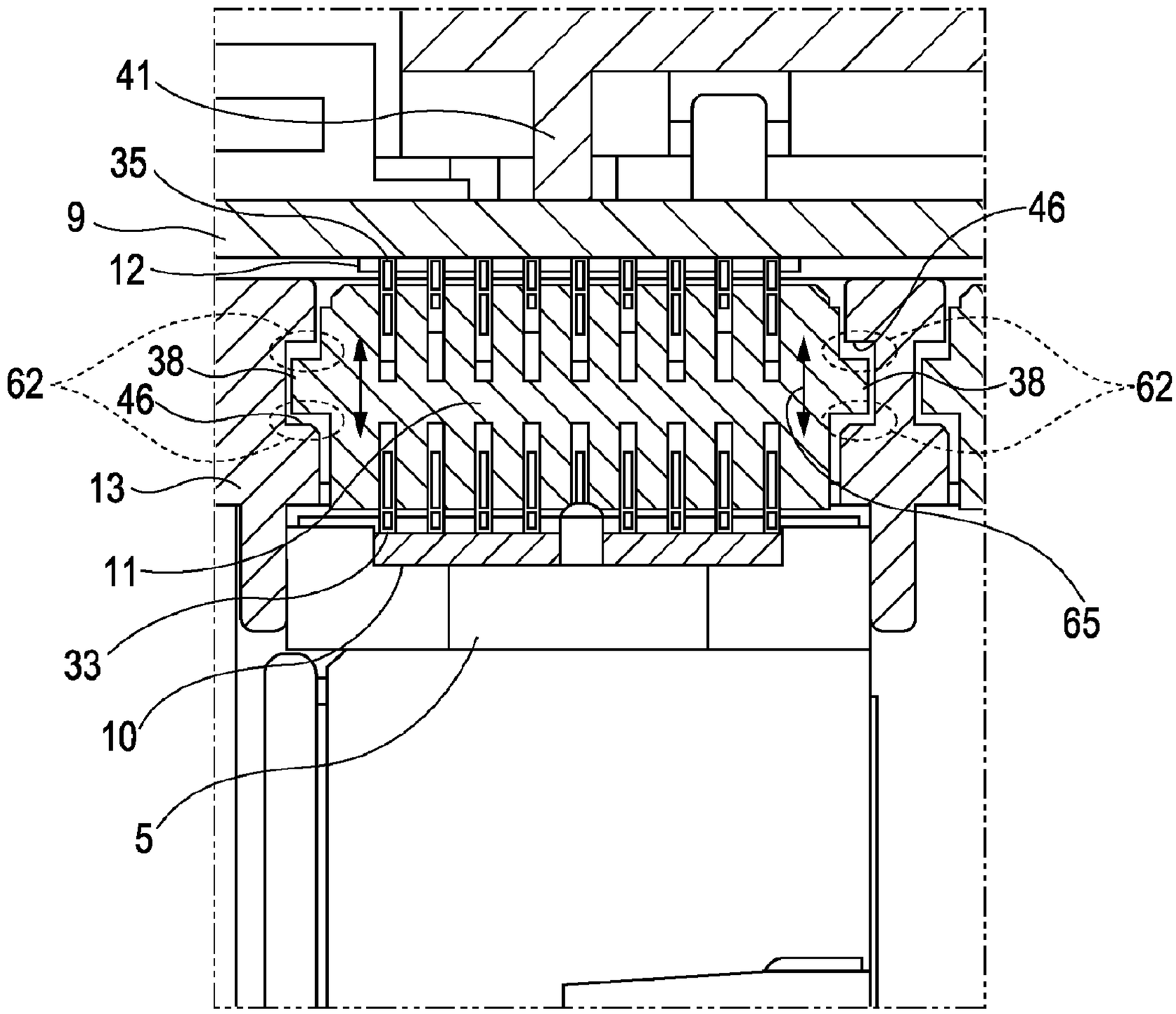


FIG. 13



CONNECTOR HOLDER UNIT, CARRIAGE, RECORDING APPARATUS, AND LIQUID EJECTING APPARATUS

BACKGROUND

1. Technical Field

The present invention relates to a connector holder unit implementing electrical conduction between an ink cartridge that is housed in a carriage with a connector and a circuit substrate installed thereto and the circuit substrate for reading information on the ink cartridge housed in a carriage through the circuit substrate, a carriage having the connector holder unit, and a recording apparatus having the carriage.

In addition, the invention relates to a liquid ejecting apparatus such as an ink jet recording apparatus performing recording (ejecting liquid) on a recording medium (liquid ejecting medium) by ejecting (injecting) liquid such as ink from its head.

Here, the term "liquid ejecting apparatus" is used for referring not only to a recording apparatus, such as a printer, a copier, and a facsimile machine, having an ink jet recording head for ejecting ink from the recording head so as to perform recording on a recording medium but also to an apparatus that causes liquid to adhere onto a medium, corresponding to the recording medium in the above described recording apparatus, by ejecting liquid selected depending on the use of the apparatus in place of ink onto the medium from a liquid ejecting head corresponding to the above-described ink jet recording head.

Examples of the liquid ejecting head other than the recording head described above are a color-material ejecting head that is used for manufacturing a color filter for liquid crystal displays or the like, an electrode material (conduction paste) ejecting head that is used for forming an electrode in an organic electroluminescent (EL) display, a field emission display (FED), or the like, a bioorganic compound ejecting head that is used for manufacturing bio-chips, and a sample spraying head as a precision pipette.

2. Related Art

In JP-A-2003-257522, there is disclosed a connector which includes a position determining attachment portion that is engaged with a front end of a memory circuit substrate and a hook portion locking a rear end of the memory circuit substrate, wherein the memory circuit substrate is attached in a detachable manner, a plurality of contact portions of the connector having spring contact with terminals of the memory circuit substrate is configured, and a contact portion having a low load among the plurality of contact portions is disposed on the position determining attachment portion side.

However, in the technology disclosed in JP-A-2003-257522, since the circuit substrate is locked into the hook portion in a sliding method using elastic deformation of the circuit substrate, there is a case where a resist of the circuit substrate or the like is cut away. Thus, there is a possibility that foreign bodies such as cut resists are interposed between the contact portions to cause deterioration of signal transmission therebetween. In addition, since the connector holder is provided inside the carriage in advance and the circuit substrate and the connector are required to be installed to the connector holder thereafter, it is relatively difficult to install the circuit substrate and the connector.

SUMMARY

An advantage of some aspects of the invention is that it provides a connector holder unit in which a circuit substrate and a connector can be installed to a connector holder in an easy manner and which does not generate foreign bodies at a time when the circuit substrate and the connector are installed, a carriage having the connector holder unit, and a recording apparatus and a liquid ejecting apparatus that have the carriage.

According to a first aspect of the invention, there is provided a connector holder unit that is formed separately from a carriage capable of housing an ink cartridge and can be attached to the inside of the carriage. The connector holder unit is provided with a connector holder, a connector having a plurality of contact arms that are installed to the connector holder, and a circuit substrate having a plurality of conductive connection portions that is installed to the connector holder. Contact terminals of the plurality of contact arms of first and second connect arms of the connector are configured to elastically contact the conductive connection portions of the circuit substrate and conductive connection portions of the ink cartridge so as to electrically conduct between the circuit substrate and the ink cartridge when the connector holder unit is attached to the carriage.

In the first aspect, since the connector holder unit is formed separately from the carriage, it is not needed to install the connector and the circuit substrate to the connector holder by using a sliding method, and accordingly, a problem such as generation of foreign bodies due to cut of resists do not occur. In addition, an operation for installment of the connector and the circuit substrate **9** can be simplified, compared to a case where the connector and the circuit substrate are installed after attachment of the connector holder to the carriage.

According to a second aspect of the invention, in the connector holder unit according to the first aspect, the circuit substrate is installed to the connector holder to have a clearance that enables the circuit substrate to be able to move in the front or rear direction of the connector holder.

While the circuit substrate and the connector are mounted on the connector holder in advance for forming the connector holder unit before being attached to the carriage according to an aspect of the invention, there is a case where it takes a long time from storage as the connector holder unit to installment of the connector holder unit to the carriage. In such case, a force pressing the circuit substrate to its back side in accordance with the spring force of the contact is applied to the connector holder, and whereby the connector holder may be deformed to be bent as a counter action thereof. Thus, there is a case where the deformed connector holder unit cannot be attached to the carriage.

In the second aspect, since the circuit substrate is attached in a status that the circuit substrate is slightly movable in the front or of rear direction of the connector holder, a spring force of the contact of the connector reduces a biasing force applied to the connector holder through the circuit substrate, and whereby bending deformation of the connector holder can be prevented.

According to a third aspect of the invention, in the connector holder unit according to the first aspect, the circuit substrate has a configuration in which the circuit substrate is pivoted about one side between upper and lower sides of the circuit substrate in a status that the side of the circuit substrate is supported by a position determining portion of the connector and the other side is approached to the connector holder for being engaged with the connector holder.

In the third aspect, since there is used a configuration in which the circuit substrate is attached to the connector holder by a pivoting movement without being sled into the connector holder, a problem such as cut of the resists due to a mistake in the attachment of the circuit substrate does not occur. In addition, since elastic deformation of the circuit substrate during the attachment operation does not occur, deterioration of quality of the circuit substrate can be prevented.

According to a fourth aspect of the invention, there is provided a carriage that can house an ink cartridge. The carriage is provided with the connector holder unit according to the first aspect.

In the fourth aspect, a carriage that can prevent generation of foreign bodies such as small fragments cut away from the resists and assuredly transmit information on the ink cartridge to the circuit substrate side is provided.

According to a fifth aspect of the invention, there is provided a recording apparatus. The recording apparatus is provided with a transport unit transporting a recording medium, a recording unit performing recording on the recording medium that is transported by the transport unit, and a carriage that reciprocates in a main scanning direction which is perpendicular to a transport direction of the recording medium. The carriage is the carriage according to the fourth aspect.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be described with reference to the accompanying drawings, wherein like numbers reference like elements.

FIG. **1** is a perspective view of a carriage for an ink jet printer according to an embodiment of the invention.

FIG. **2**A is a side sectional view of a connector and the vicinity thereof according to an embodiment of the invention.

FIG. **2**B is an enlarged side sectional view of the connector and a lower side thereof.

FIG. **3** is a perspective view of the inside of a carriage according to an embodiment of the invention at a time right before installment of a connector holder unit.

FIG. **4** is a perspective view of the inside of the carriage at a time when the connector holder unit is installed.

FIG. **5** is an exploded perspective view of constituent members adjacent to the connector holder according to an embodiment of the invention.

FIG. **6** is a longitudinal sectional view of a connector according to an embodiment of the invention.

FIG. **7** is a perspective view of the inside of a carriage according to an embodiment of the invention, showing the vicinity of a circuit substrate.

FIG. **8** is a perspective view of the back side of a connector holder unit according to an embodiment of the invention.

FIG. **9** is a perspective view of the front side of a connector holder unit according to an embodiment of the invention.

FIGS. **10**A to **10**E are diagrams showing an operation of attaching a circuit substrate to a connector holder according to an embodiment of the invention.

FIGS. **11**A to **11**D are diagrams showing an operation of attaching a circuit substrate to a connector holder according to another embodiment of the invention.

FIG. **12** is a vertical sectional view showing a clearance between a support portion of a connector holder and a supported portion of a housing according to an embodiment of the invention.

FIG. **13** is a horizontal sectional view of the circuit substrate and the connector holder shown in FIGS. **11**A to **11**D.

DESCRIPTION OF EXEMPLARY EMBODIMENTS

Hereinafter, an embodiment of the present invention will be described with reference to the accompanying drawings. FIG. **1** is a perspective view of a carriage for an ink jet printer according to an embodiment of the invention. FIG. **2**A is a side sectional view of a connector and the vicinity thereof

according to an embodiment of the invention. FIG. **2**B is an enlarged side sectional view of the connector and a lower side thereof. FIG. **3** is a perspective view of the inside of a carriage according to an embodiment of the invention at a time right before installment of a connector holder unit. FIG. **4** is a perspective view of the inside of the carriage at a time when the connector holder unit is installed. FIG. **5** is an exploded perspective view of constituent members adjacent to the connector holder according to an embodiment of the invention. FIG. **6** is a longitudinal sectional view of a connector according to an embodiment of the invention. FIG. **7** is a perspective view of the inside of a carriage according to an embodiment of the invention, showing the vicinity of a circuit substrate. FIG. **8** is a perspective view of the back side of a connector holder unit according to an embodiment of the invention. FIG. **9** is a perspective view of the front side of a connector holder unit according to an embodiment of the invention. FIGS. **10**A to **10**E are diagrams showing an operation of attaching a circuit substrate to a connector holder according to an embodiment of the invention. FIGS. **11**A to **11**D are diagrams showing an operation of attaching a circuit substrate to a connector holder according to another embodiment of the invention.

In FIG. **1**, reference numeral **1** denotes a carriage **1**, and a recording head unit **2** (see FIGS. **2**A and **2**B) is provided on the lower side of the carriage **1**. The recording head unit **2** includes a head portion **4** having a nozzle array (not shown) for ejecting ink and a head base body **40** having a position determining portion **18** by which an ink outlet portion **20** of an ink cartridge **5** is set together with fixing of the head portion **4** for determination of the position of the ink. A lower position determining rib **8** partitioning the position determining portion **18** of the head base body **40** is configured to serve as a supported portion **24** to be described later. The recording head unit **2** is fastened to be fixed to the carriage **1** through a support portion **46** locating on the outer side of the lower position determining rib **8** of the head base body **40**.

The carriage **1** can reciprocate along a carriage guide shaft or a carriage guide rail **3** in a direction perpendicular to a transport direction of a recording medium and performs recording on the recording medium. In the carriage **1**, there is formed a plurality of cartridge receiving portions **7** for containing the ink cartridges **5**. In description below, a side facing a left-front side in FIG. **1** is referred to as a front side of the carriage **1** and an opposite side thereto is referred to as a back side of the carriage **1**. Like the carriage **1**, sides of members attached to the carriage **1** will be referred to as front and back sides in accordance with their attached sides of the carriage **1**. Specifically, sides of a connector holder in a status that the connector holder is attached to the inside of the carriage will be referred to as the same sides as the sides of the carriage.

On the back side of the carriage **1**, a circuit substrate **9** (see FIG. **2**A and **2**B) is provided, and a conductive connection portion **12** is formed on the circuit substrate **9**. On a back side of an inner face of the carriage **1**, connectors **11** are provided in correspondence with the cartridge receiving portions **7**. The connectors **11** are held by connector holders **13** (see FIG. **9**). As shown in FIG. **3**, the connector holder **13** is held by fitting both ends **14** of the connector holder **13** to a groove portion **16** of the carriage **1** using a sliding method. In this holding status, the connector holder **13** is configured to be located above the support portion **46** inside the carriage **1**. To be more specific, the recording head unit **2** and the connector holder **13** are configured to be overlapped with each other in an assembly direction, and whereby it is possible to decrease a size of the carriage **1** in its inner depth direction.

According to an embodiment of the invention, all the connector **11** and the circuit substrate **9** are attached to the connector holder **13** in advance before the connector holder **13** is attached to the carriage **1**. However, in description below, a

connector holder unit **74** is defined as a connector holder **13** to which all the connector **11** and circuit substrate **9** have been attached in advance.

An inside bottom portion of the carriage **1** is constituted by the head base body **40** of the recording head unit **2**. In this portion, ink supply openings **6** are formed to protrude in accordance with the cartridge receiving portions **7**, peripherals of the ink supply openings **6** are partitioned by the protruding lower position determining rib **8**, and the inside of partitioned portion is configured to be the position determination portion **18** for determination of the position of the ink cartridge **5**. In this embodiment, four position determining portions **18** are formed corresponding to the cartridge receiving portions **7**. On a connector holder **13** side of the lower position determining rib **8**, that is, a wall face opposite to the position determining portions **18** is formed to be a supported portion **24**. The operation of the supported portion **24** will be described later.

In each ink cartridge **5**, as shown in FIG. **5**, a cartridge side substrate **15** is formed on a face facing the connector **11** and a locking lever **17** (see FIG. **1**) used for fixing the ink cartridge **5** to the carriage **1** is provided above the cartridge side substrate **15**. In addition, on the cartridge side substrate **15**, conductive connection portions **10** (see FIG. **5**, etc.) are formed. The ink cartridge **5** is configured to be fixed to the inside of the cartridge receiving portion **7** using snap fitting by slight and temporary elastic deformation of the locking lever **17** at a time when the ink cartridge **5** is pushed into the cartridge receiving portion **7**.

The connector **11**, as shown in FIG. **6**, includes a first face **19** facing the cartridge side substrate **15** and a second face **21** facing the circuit substrate **9** that is provided on the back side of the carriage **1**. The connector **11** has a function for electrical conduction between the cartridge side substrate **15** and the circuit substrate **9** by being interposed therebetween. The connector **11**, for example, has nine metal contacts **25** that are disposed parallel to one another for a housing **23** made of known materials. The nine contacts **25** are disposed in two lines to be in the same position every other line when viewed from the side, and contacts **25** adjacent to each other are disposed to be in different positions in the longitudinal direction of the housing **23** and are disposed in a zigzag pattern on the whole.

The contacts **25** have a same shape. Each contact **25** includes a first contact arm **29** that extends to the first face **19** side from a base end portion **27** and a second contact arm **31** that extends to the second face **21** side and is shorter than the first contact arm **29**, as main frames. In front ends of the contact arms **29** and **31**, contact terminals **33** and **35** in the shape of an approximate half circle are formed. The second contact arm **31** is formed shorter than the first contact arm **29**. A base end portion **27** of each contact **25** is press-fitted to a thin plate-shaped portion **37** formed in the housing **23**, and whereby the contact **25** is supported by the housing **23**.

The contact terminals **33** and **35** of the first and second contact arms **29** and **31** respectively protrude from the first and second faces **19** and **21**, and the first and second contact arms **29** and **31** are configured to bend inward in the shape of a plate spring when load is applied to the contact terminals **33** and **35**. By the action of the spring, the contact terminals **33** and **35** can be brought into tight contact with the conductive connection portion **10** of the cartridge side substrate **15** and the conductive connection portion **12** of the circuit substrate **9**, and accordingly, electrical connection therebetween can be made assuredly.

As shown in FIG. **8**, the circuit substrate **9** is held on the back side of the connector holder **13** by holding ribs **39**. In a status that the connector holder **13** is set inside the carriage **1**, as shown in FIG. **7** (the connector holder **13** is omitted in the figure for easy understanding), four back side support portions **41** having a shape of a rib formed inside the carriage **1** are brought into contact with the back side of the circuit substrate **9** so as to prevent backward bending-like deformation of the circuit substrate **9**. As described above, since a force for bending the circuit substrate **9** outward is applied when the contact terminals **33** and **35** are brought into tight contact with the conductive connection portion **10** of the cartridge side substrate **15** and the conductive connection portion **12** of the circuit substrate **9**, the prevention of the deformation of the circuit substrate **9** is made for maintaining electrical connection assuredly by regulating the bending of the circuit substrate **9**.

As shown in FIG. **9**, in a bottom portion of the front side, that is, the ink cartridge **5** side of the connector holder **13**, a deformation preventing support portion **43** is formed. The deformation preventing support portion **43** is provided as a convex portion around the center of the connector holder **13**. The deformation preventing support portion **43** has a trapezoid shape, and a shorter side of the trapezoid is formed as a support face **45**. As shown in FIG. **4**, the dimension of the deformation preventing support portion **43** is set such that the support face **45** is brought into contact with the supported portion **24** formed on the connector holder **13** side of the lower position determining rib **8** when the connector holder **13** is set inside the carriage **1**.

As described above, since the deformation preventing support portion **43** is configured to contact the supported portion **24** provided inside the carriage **1** when the connector holder **13** is set inside the carriage **1**, the following advantages can be obtained.

Since a force for bending the circuit substrate **9** outward is suppressed by the back side support portion **41** when the contact terminals **33** and **35** tightly contact the conductive connection portion **10** of the cartridge side substrate **15** and the conductive connection portion **12** of the circuit substrate **9**, the connector holder **13** tends to bend to the ink cartridge **5** side as a counteraction thereof. However, since the deformation preventing support portion **43** is brought into contact with the supported portion **24**, the connector holder **13** can continuously maintain its original form without being bent to the ink cartridge **5** side. Thus, deformation of the circuit substrate **9** on the basis of the deformation of the connector holder **13** can be suppressed, and accordingly, it is possible to maintain a status of excellent connection between the contact terminals **33** and **35** and the conductive connection portions **10** and **12**.

Especially when the ink cartridge **5** is in a status of being detached from the cartridge receiving portion **7**, elastic contact between the conductive connection portion **10** of the ink cartridge **5** and the connector **11** disappears, and thus, a force for reducing the deformation of the connector holder **13** to the ink cartridge **5** side disappears from that portion. In this embodiment of the invention, even in such case, the deformation of the connector holder **13** is suppressed by using a structure for bring the support portion **43** into contact with the supported portion **24**.

In addition, since the lower position determining rib **8** partitioning the position determining portion **18**, by which the ink outlet portion **20** of the ink cartridge **5** is set for determining the position of the ink cartridge **5**, is configured to serve as the supported portion **24**, that is, both wall faces of inner and outer wall faces of the lower position determining rib **8** partitioning the position determining portion **18** of the head base body **40** perform a position determining function of the ink

cartridge **5** and a deformation preventing function of the connector holder **13**, the contact distance and contact pressure between the conductive connection portion **10** of the ink cartridge **5** and the connector **11** can be adjusted with high precision.

Hereinafter, a configuration according to an embodiment of the invention will be described. As described above, a basic feature of the invention is that the connector **11** and the circuit substrate **9** are attached to the connector holder **13** in advance for forming the connector holder unit **74** other than that the connector **11** and the circuit substrate **9** are attached to the connector holder **13** after attachment of the connector holder **13** to the carriage **1**. As described above, since a form of the connector holder unit **74** is used, it is not needed to install the circuit substrate **9** to the connector holder **13** by using a sliding method, and accordingly, a problem such as generation of foreign bodies due to cut of resists does not occur. In addition, an operation for installment of the connector **11** and the circuit substrate **9** can be simplified, compared to a case where the connector **11** and the circuit substrate **9** are attached after attachment of the connector holder **13** to the carriage **1**.

In a process for assembly of the connector holder unit **74**, for example, methods shown in FIGS. **10**A to **10**E and **11**A to **11**D can be used for the attachment of the circuit substrate **9** to the connector holder **13**. In the method shown in FIGS. **10**A to **10**E, as shown in FIG. **10**A, a flexible hook **53** is formed in the connector holder **13** and a locking portion (not shown) into which the flexible hook **53** is locked is formed in a position corresponding to a position of the flexible hook **53** on the circuit substrate side **9**. As shown in FIG. **10**B, an upper side **47** of the circuit substrate **9** is fixed to the inside of a reverse concave-shaped position determining portion **49**. Thereafter, as shown in FIG. **10**C, the circuit substrate **9** is pivoted about the fixed upper side **47** (center of pivoting) so as to approach a lower side **51** to the connector holder **13** side. When the conductive connection portion **12** is brought into contact with the contact terminal **35**, as shown in FIG. **10**D, the upper **47** side of the circuit substrate **9** moves to a back side from the contact terminal **35**. As shown in FIG. **10**E, finally, the lower side **51** side of the circuit substrate **9** is fixed by locking a locked portion with a front end locking portion **54** of the flexible hook **53** and the upper side **47** side of the circuit substrate **9** is locked with the rear side of the reverse concave-shaped position determining portion **49** for being fixed.

In the method shown in FIGS. **11**A to **11**D, as shown in FIG. **11**A, a position determining guide protrusion **55** and a screw combining portion (not shown) are formed in the connector holder **13**, and an opening (not shown) through which the position determining guide protrusion **55** passes is formed on the circuit substrate side **9**. As shown in FIG. **11**A, the upper side **47** of the circuit substrate **9** is fixed to the reverse concave-shaped position determining portion of the connector holder **13**. Thereafter, as shown in FIG. **11**B, the circuit substrate **9** is pivoted about the fixed upper side **47** so as to approach the lower side **51** to the connector holder **13** side. Then, the circuit substrate **9** is pivoted to a predetermined position such that the position determining guide protrusion **55** is inserted into the opening, and as shown in FIG. **11**C, a fixing screw **57** is screwed into a screw coupling portion, and whereby the lower side **51** side of the circuit substrate **9** is fixed to have a clearance in front and rear directions by a head portion **59** of the fixing screw **57** (see FIG. **11**D).

As shown in FIG. **10**E of the embodiment shown in FIGS. **10**A to **10**E described above, when the circuit substrate **9** is attached to the connector holder **13**, the upper side **47** of the circuit substrate **9** is configured to be able to slightly move in the front or rear direction of the connector holder, as denoted by an arrow **63**, in the range of the clearance **58** formed in the reverse concave-shaped position determining portion **49**. In addition, the lower side **51** side of the circuit substrate **9** is configured to be able to move between positions in a status (FIG. **10**E) that a front end locking portion **54** of the flexible hook **53** is locked into the locking portion and a status (FIG. **10**D) that the lower side **51** side is pushed in a front direction for resisting an elastic force of the contact terminal **35**. As a result, the circuit substrate **9** is attached to the connector holder **13** in a status that the circuit substrate **9** can slightly move in the front or rear direction of the connector holder **13**. The embodiment shown in FIGS. **11**A to **11**D operates the same as described above by providing the clearance.

As described above, since the circuit substrate **9** is connected to the connector holder **13** in a status that the circuit substrate **9** is movable in a front or rear direction of the connector holder **13**, the following advantages can be obtained. While the circuit substrate **9** and the connector **11** are mounted on the connector holder **13** in advance for forming the connector holder unit **74** before being attached to the carriage **1** according to a embodiment of the invention, there is a case where it takes a long time from storage as the connector holder unit **74** to installment of the connector holder unit **74** to the carriage **1**. In such case, a force pressing the circuit substrate **9** to its back side in accordance with the spring force of the contact **25** is applied to the connector holder **13**, and whereby the connector holder **13** may be deformed to be bent. Thus, there is a case where the deformed connector holder unit **74** cannot be attached to the carriage **1**. However, since the circuit substrate **9** is attached in a status that the circuit substrate **9** is slightly movable in the front or of rear direction of the connector holder **13**, a spring force of the contact **25** reduces a biasing force applied to the connector holder **13**, and whereby bending deformation of the connector holder **13** can be prevented.

In addition, in the form of the connector holder unit **74**, although the circuit substrate **9** is slightly movable in the front or rear direction of the connector holder **13**, the contact terminals **33** and **35** can be brought into tight contact with the conductive connection portion **10** of the cartridge side substrate **15** and the conductive connection portion **12** of the circuit substrate **9** on the basis of the spring action by attaching the connector holder unit **74** to the carriage **1**, and the position of the circuit substrate **9** with respect to the carriage **1** is fixed by the back side support portion (rib) **41** inside the carriage.

As shown in FIGS. **12** and **13**, a clearance **62** is formed between the support portion **46** (see FIG. **5**) of the connector holder **13** and the supported portion **38** (see FIG. **5**) of the housing **23** of the connector **11** such that the housing **23** is slightly movable in the front or rear direction of the connector holder **13**. According to an embodiment of the invention, the housing **23** of the connector **11** is configured to be slightly movable in the front or rear direction of the connector holder **13** and the circuit substrate **9** may not be configured to be movable with respect to the connector holder **13**.

In this embodiment of the invention, since the clearance **62** through which the housing **23** can move with respect to the connector holder unit **74** is formed between the support portion **46** of the connector holder **13** and the supported portion **38** of the housing **23**, the housing **23** is slightly movable with respect to the connector holder unit **74**. Accordingly, although the connector holder **13** inside the carriage **1** is deformed to be bent for any reason, the deformation force is absorbed by the clearance **62**, and thus, the effect of the deformation on the status of contact between the contact terminals **33** and **35** of

the connector side **11** and the conductive connection portion **10** of the ink cartridge **5** and/or the conductive connection portion **12** of the circuit substrate **9** can be prevented.

In other words, in a status that the connector unit **74** in which the connector **11** and the circuit substrate **9** are installed to the connector holder **13** is attached to the carriage **1**, the contact terminals **33** and **35** of the connector **11** are brought into elastic contact with the conductive connection portion **10** of the ink cartridge **5** and the conductive connection portion **12** of the circuit substrate **9**, and whereby electrical conduction between the circuit substrate **9** and the ink cartridge **5** is made.

In this status of the elastic contact, since the positions of the contact terminals **33** and **35** of the connector **11**, the conductive connection portion **10** of the ink cartridge **5**, and the conductive connection portion **12** of the circuit substrate **9** are maintained in a status that contact pressures of the contact portions are balanced by the elastic force, it is preferable that the position of the connector **11** is not restricted by the connector holder **13** in this status for optimization of the balance. According to an embodiment of the invention, an appropriate structure is implemented by using the clearance **62**, and since the position of the connector **11** is not restricted to have a degree of freedom by using the clearance **62**, the balance of contact pressures of the contact portions is improved. In addition, although the connector holder **13** is deformed for any reason, the effect thereof can be prevented.

Since the circuit substrate **9** and the connector **11** are mounted on the connector holder **13** to form the connector holder unit **4** before the attachment of the connector holder **13** to the carriage **1**, the following advantages can be obtained. There is a case where it takes a long time from storage as the connector holder unit **4** to installment of the connector holder unit **74** to the carriage **1**. In such case, a force pressing the circuit substrate **9** or the housing **23** to its back side in accordance with the spring force of the contact **25** is applied to the connector holder **13**, and whereby the connector holder **13** may be deformed to be bent. As a result, there is a case where the deformed connector holder unit **4** cannot be attached to the carriage **1**. According to an embodiment of the invention, since the effect of the biasing force applied to the connector holder **13** in accordance with the spring force of the contact **25** is reduced by using the clearance **62**, and whereby bending deformation of the connector holder **13** in its front and rear direction can be prevented.

In the embodiment described above, the circuit substrate **9** and the connector **11** are configured to be movable in the front or rear direction of the connector holder **13**, but the circuit substrate **9** and the connector **11** may be configured to be movable in an upper or lower direction in FIGS. **11**A to **11**D or in a front or back sides of page space of FIGS. **11**A to **11**D. As described above, by diversification of the movable directions of the circuit substrate **9** and the connector **11**, the bending deformation of the connector holder **13** in various directions other than the front or back direction can be prevented.

While an embodiment of the invention has been described, however, various modified examples thereof can be used. In the above-described embodiment, although an ink jet printer as a recording apparatus is described as an example, the present invention may be applied to a liquid ejecting apparatus that causes liquid to adhere onto a medium, corresponding to the recording medium in the above described recording apparatus, by ejecting liquid selected depending on the use of the apparatus in place of ink onto the medium from a liquid ejecting head corresponding to the above-described ink jet recording head.

The entire disclosure of Japanese Patent Application Nos: 2006-173002, filed Jun. 22, 2006 and 2006-173003, filed Jun. 22, 2006 are expressly incorporated by reference herein.

What is claimed is:

1. A connector holder unit that is formed separately from a carriage capable of housing an ink cartridge and can be attached to the inside of the carriage, the connector holder unit comprising:

a connector holder;

a connector having a plurality of contact arms that is installed to the connector holder; and

a circuit substrate having a plurality of conductive connection portions that is installed to the connector holder,

wherein contact terminals of the plurality of contact arms of the connector are configured to elastically contact the conductive connection portions of the circuit substrate and conductive connection portions of the ink cartridge so as to electrically conduct between the circuit substrate and the ink cartridge when the connector holder unit is attached to the carriage,

wherein the connector holder includes a support portion supporting a housing,

wherein the housing includes a supported portion supported by the support portion,

wherein a clearance that enables the housing to move with respect to the connector holder unit is formed between the support portion of the connector holder and the supported portion of the housing, and

wherein the circuit substrate has a configuration in which the circuit substrate is pivoted about one side between upper and lower sides of the circuit substrate in a status that the side of the circuit substrate is supported by a position determining portion of the connector and the other side is approached to the connector holder for being engaged with the connector holder.

2. The connector holder unit according to claim **1**,

wherein the plurality of contact arms includes a first contact arm that protrudes from a first face side facing a cartridge side substrate and a second contact arm that is provided on a back side of the carriage and protrudes from a second face side facing the circuit substrate.

3. The connector holder unit according to claim **2**,

wherein contact terminals in the shape of a half circle are provided in front ends of the plurality of contact arms, and

wherein the length of the second contact arm is formed to be shorter than that of the first contact arm.

4. The connector holder unit according to claim **1**,

wherein the circuit substrate is installed to the connector holder to have the clearance that enables the circuit substrate to move in the front or rear direction of the connector holder.

5. A carriage that can house an ink cartridge, the carriage comprising the connector holder unit according to claim **1**.

6. A recording apparatus comprising:

a transport unit transporting a recording medium;

a recording unit performing recording on the recording medium that is transported by the transport unit; and

a carriage that reciprocates in a main scanning direction which is perpendicular to a transport direction of the recording medium,

wherein the carriage is the carriage according to claim **5**.

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